Post-operative AKI

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Post-operative AKI - prevention is better than cure?

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Acute Kidney Injury (AKI) could be considered as a sentinel post-operative complication as it is relatively common and strongly associated with increased short and long term risk of death, the development of other post-operative complications, increased length of hospital stays and potentially the development of progressive chronic kidney disease [1]. Consequently patients with AKI after surgery constitute an area of unmet clinical need and a major burden on healthcare resources. In the absence of effective interventions to treat established AKI, pre-operative identification of patients at high risk of AKI allows for peri-operative optimisation to prevent or reduce the severity of AKI. A number of large retrospective studies have examined the associations of post-operative AKI in multivariable modelling, however few of these have led to externally validated models that have been operationalised to give predictions in a clinical setting particularly in patients undergoing non-cardiac surgery[2]. There are currently several validated AKI-risk scores for patients undergoing cardiac surgery, one in orthopedic surgery[3] and most recently, a model derived through machine-learning capable of forecasting the development of a range of post-operative complications, including AKI, across a range of surgical settings[4]. In this issue of the Journal of American Society of Nephrology, Park et al address this gap in the literature through the development of the SPARK classification, an externally validated pre-operative AKI risk score for non-cardiac surgery[5]. This model was developed in 51,041 patients and validated in 39,764 patients from South Korea and utilises 9 pre-operative variables: age, sex, baseline estimated glomerular filtration rate, urinary albuminuria, expected surgery duration, emergency operation, diabetes mellitus, renin-angiotensin-aldosterone system blockade usage, hypoalbuminemia, anaemia and hyponatremia. In contrast to other risk scores, this risk score additionally considers AKI severity by predicting a composite 'critical AKI'; outcome of Stage 2 or greater AKI, need for renal replacement therapy within 90 days of AKI or death occurring after any AKI diagnosis. By allowing pre-operative risk stratification of patients this tool could assist clinicians in a number of ways. It can inform discussions with patients prior to

surgery, allowing for a clearer and more candid quantification of the risks of an important medical complication of surgery and the potential benefits of surgical treatment to be better weighed against risks of complications and adverse longer term outcomes. As we are increasingly facing an ageing, multimorbid population we need to carefully consider these adverse potential consequences of which can often affect organ systems remote from the site of surgical disease. In addition, identifying high risk patients can guide pre-operative planning by influencing whether patients would benefit from more intensive monitoring in the post-operative period possibly in a critical care setting.

Nevertheless, it could be argued that risk stratification is pointless since it remains unclear what the proposed intervention(s) should be for patients at high risk for AKI, and whether these interventions are in fact effective. However, recent studies have shown that risk stratification of patients at high risk of AKI diagnosis in the post-operative setting might enable effect intervention with a "bundle" of AKI-directed preventative measures. These studies examined the implementation of an AKI prevention bundle derived from recommendations in the Kidney Disease Improving Global Outcomes (KDIGO) 2012 AKI guidelines[6] to patients deemed at high risk of AKI based on post-operative urinary AKI biomarkers (insulin-like growth factor-binding protein 7 (IGFBP7) and tissue inhibitor of metalloproteinases-2 (TIMP-2)). These interventions comprised of the avoidance of potentially nephrotoxic agents, close monitoring of serum creatinine and urine output, and optimization of volume status and haemodynamic parameters. In cardiac surgery this approach has been shown to reduce post-operative AKI diagnosis, but without evidence of benefit for longer term renal outcomes[7], while application of a similar strategy in general surgery was overall negative, but demonstrated a signal of benefit in a subgroup of patients with moderately elevated AKI biomarkers suggestive of benefit in early but not more established AKI[8]. Whilst preliminary these results do suggest a KDIGO based AKI prevention bundle would be the obvious intervention in patients stratified as high risk for peri-operative AKI. However, AKI biomarkers are costly and not currently routinely or widely available and have thus far been only utilised in relatively small

studies with equivocal results. The application of a risk score using readily available pre-operative parameters could provide a relatively cheap and simple means of risk stratification that could be applicable to post-operative AKI prevention and management to many patients in a variety of income-settings. Importantly in the setting of intensive care unit admissions, AKI risk-prediction algorithms based on routinely available data have been shown to have comparable diagnostic performance to AKI-biomarkers[9], reinforcing the role of predictive models as an alternative or complement to biomarkers in risk-stratification for clinical decision making.

The SPARK risk score is thus a promising tool that could be investigated in prospective studies for targeted AKI preventative bundled intervention, either as randomised studies or perhaps, given the established nature of the components of bundled care, as a quality improvement intervention. Currently, this model is limited in its generalizability as it was both developed and validated in Korean patients and further external validation is required to ensure its applicability to other populations worldwide before consideration of widespread implementation. However, the approach of risk-stratification of patients for sentinel surgical complications is likely to be an increasingly important method of improving, not just peri-operative care, but the ongoing global healthcare of surgical patients and the ability of patients and doctors to make informed decisions about their surgical treatment.

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